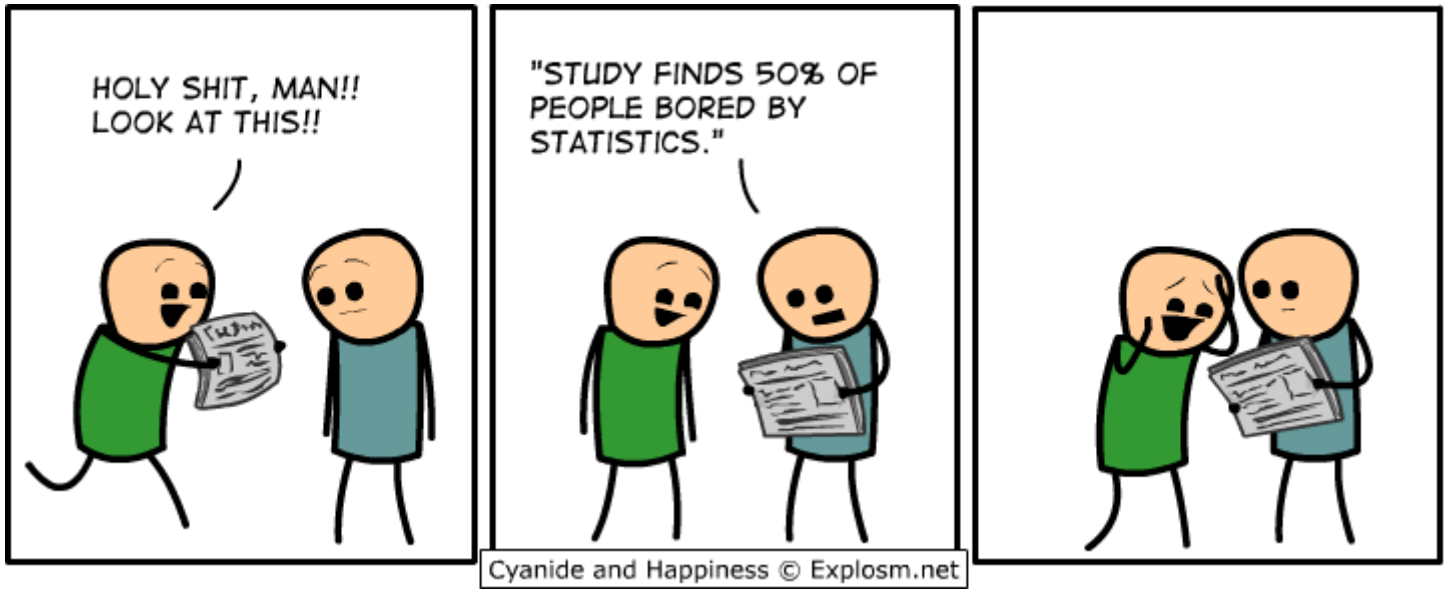
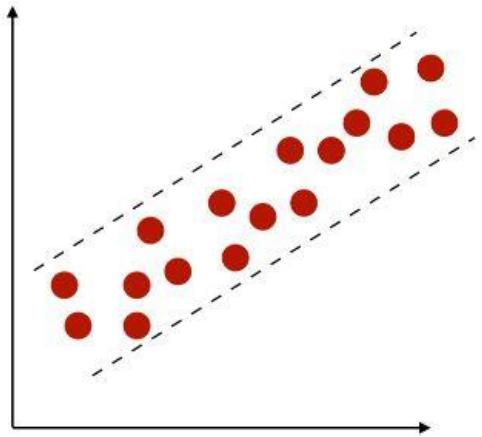
Heteroscadisticity

Data Set: **magpo.xlsx**

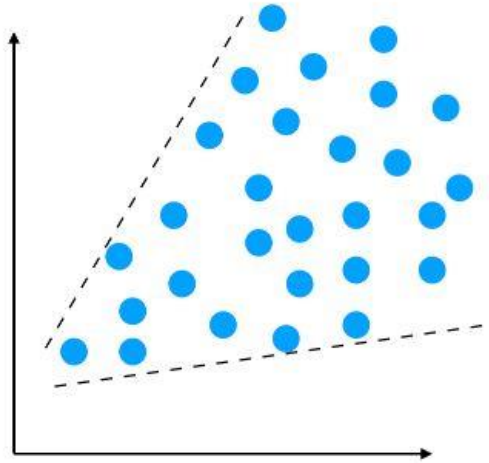
Source: Chapter 7, Introduction to Econometrics by Christopher Dougherty, 3rd edition, publisher: Oxford



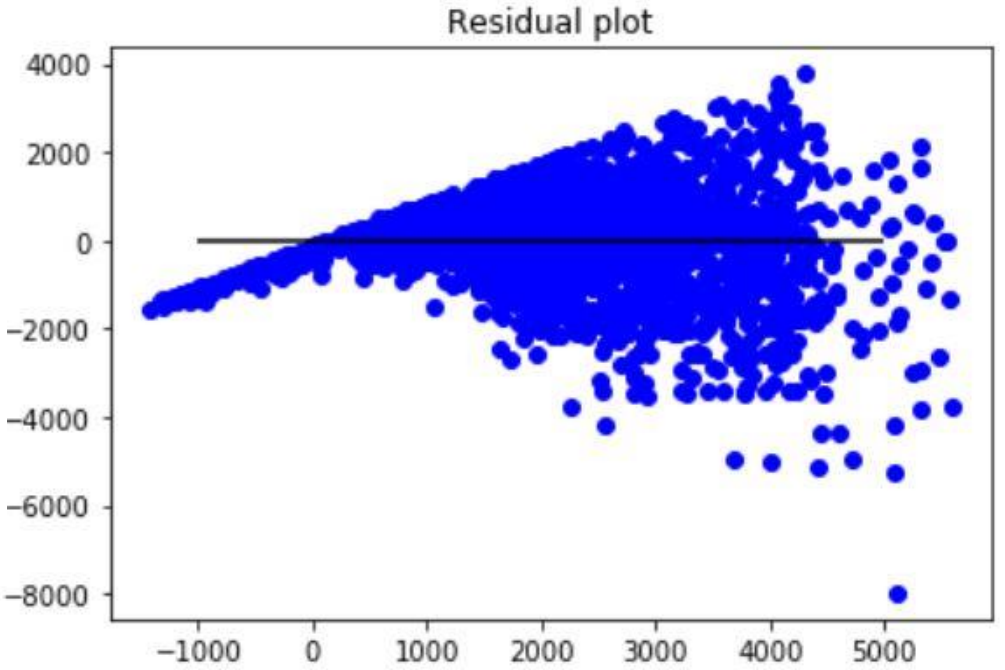
Heteroscadisticity



Homoscedasticity



Heteroscedasticity



Variance of each term in X is constant

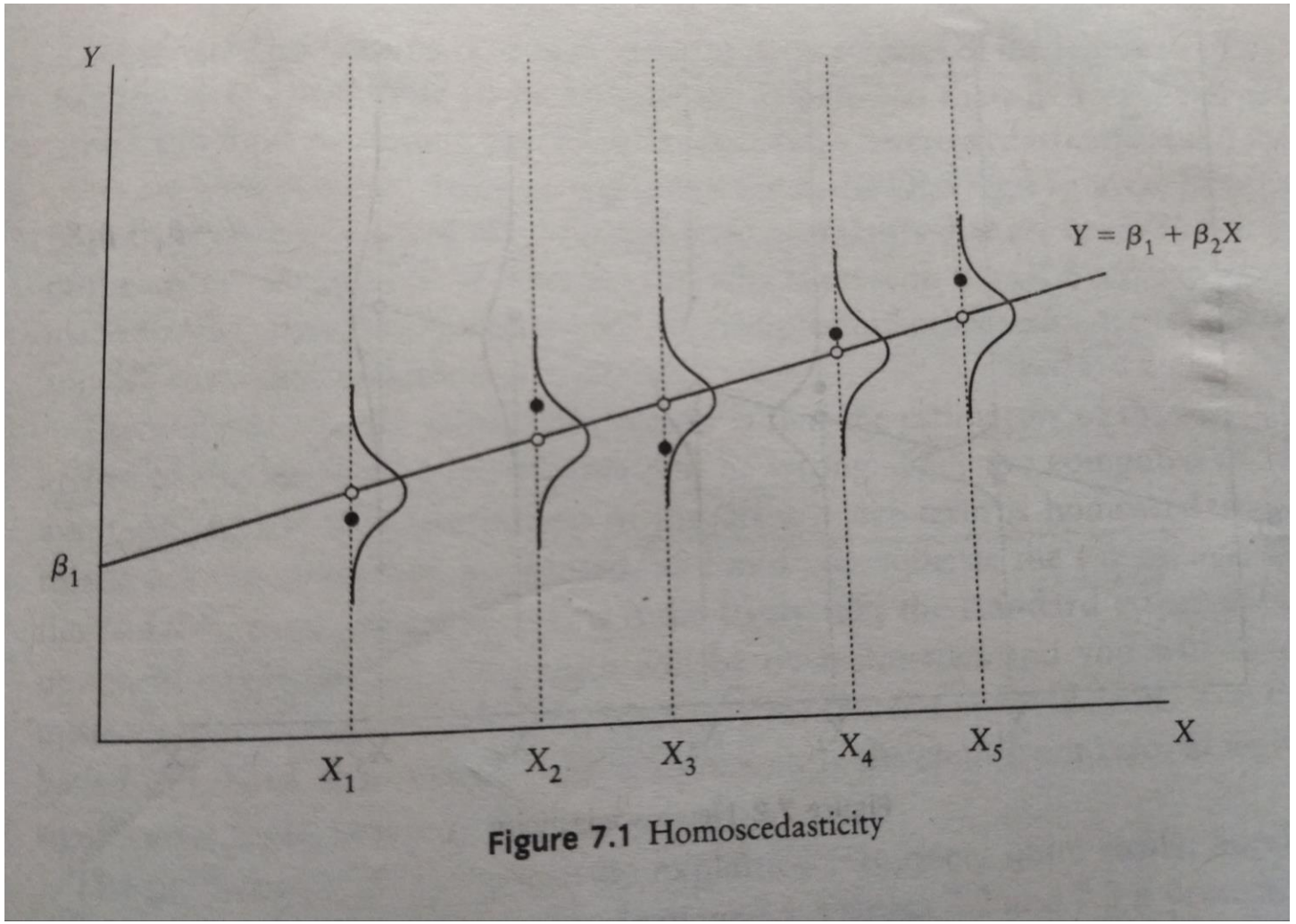


Figure 7.1 Homoscedasticity

Variance of each term in X is NOT constant

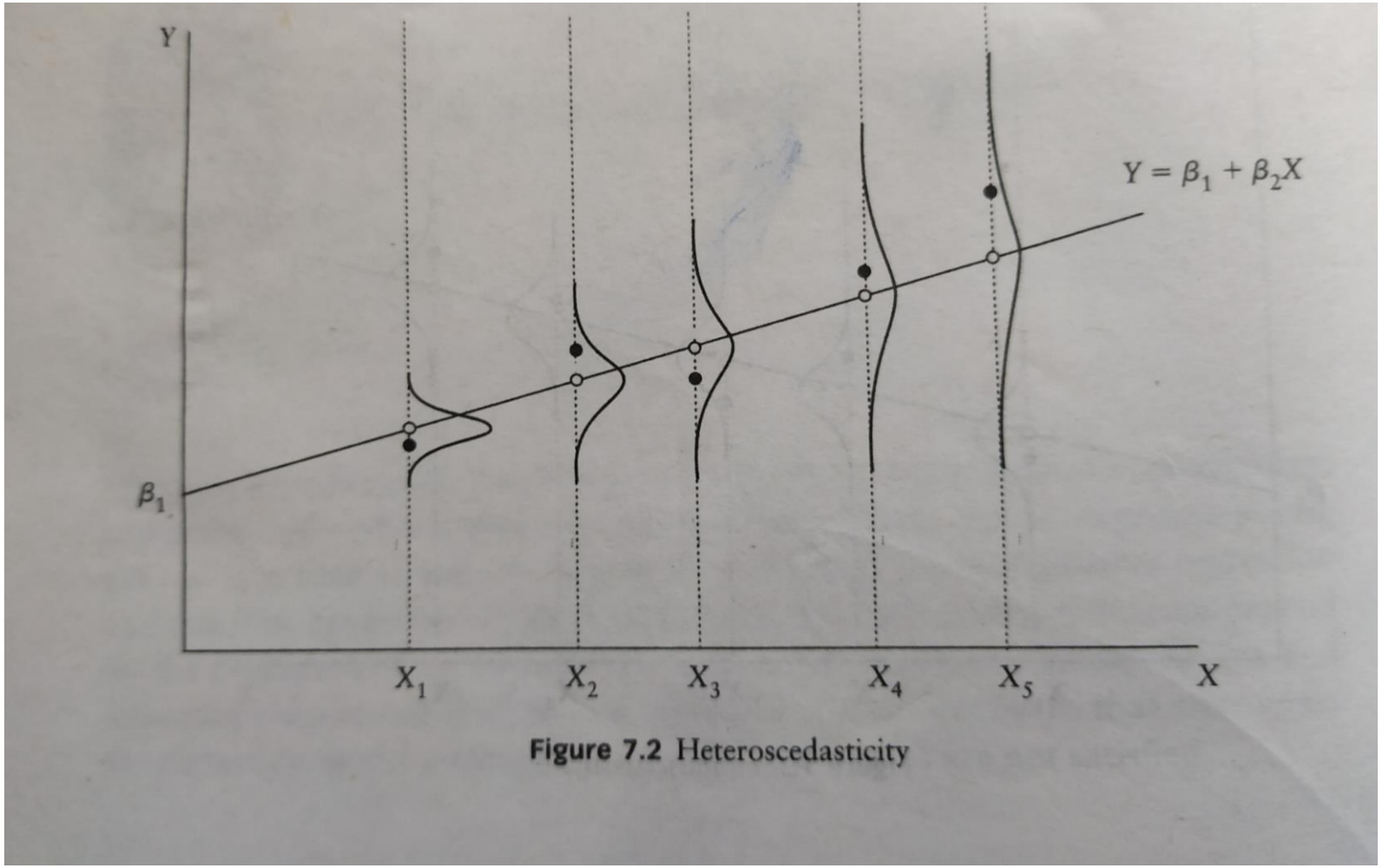
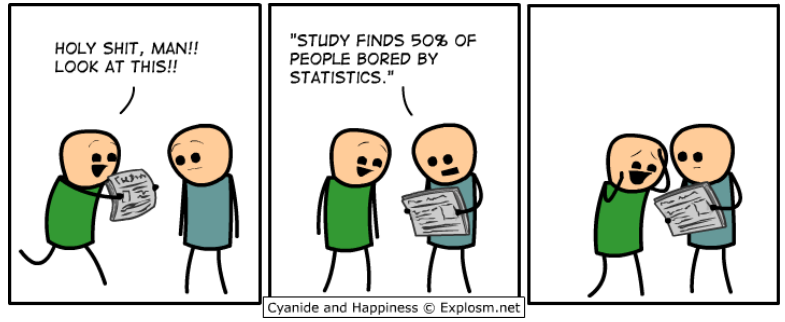


Figure 7.2 Heteroscedasticity



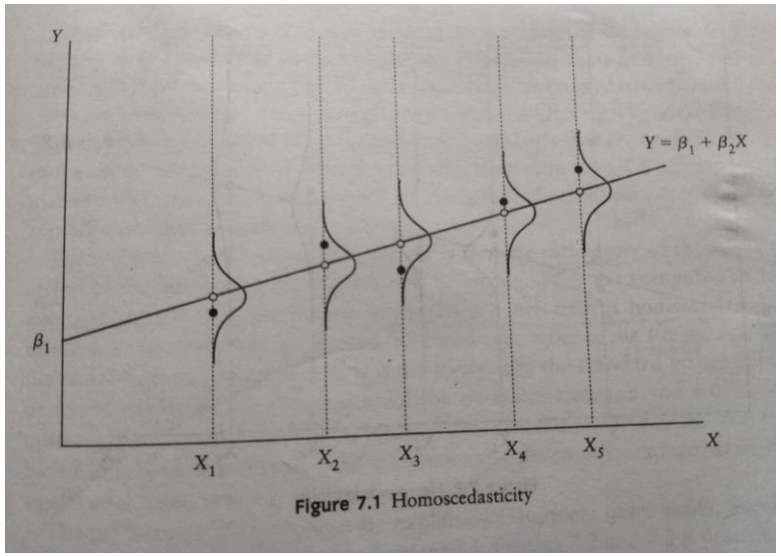


Figure 7.1 Homoscedasticity

What is the meaning of Variance of "each" term?

Dehradun, Jalandhar, Pune

sta·tis·tics

[st*uh*-**tis**-tiks], *n*,

1. the only science where two recognized experts, using exactly the same set of data, may come to completely opposite conclusions.

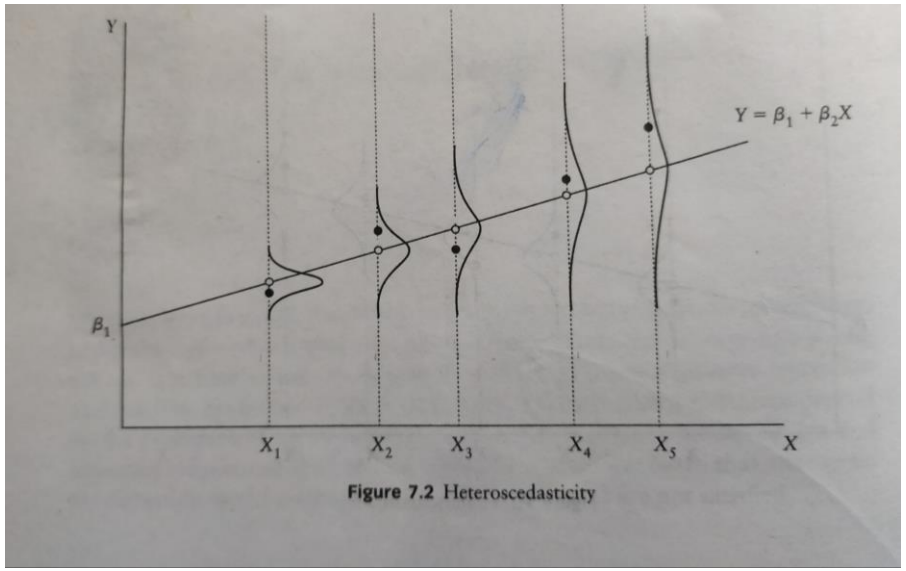


Figure 7.2 Heteroscedasticity

Data

Data belongs to year 1994

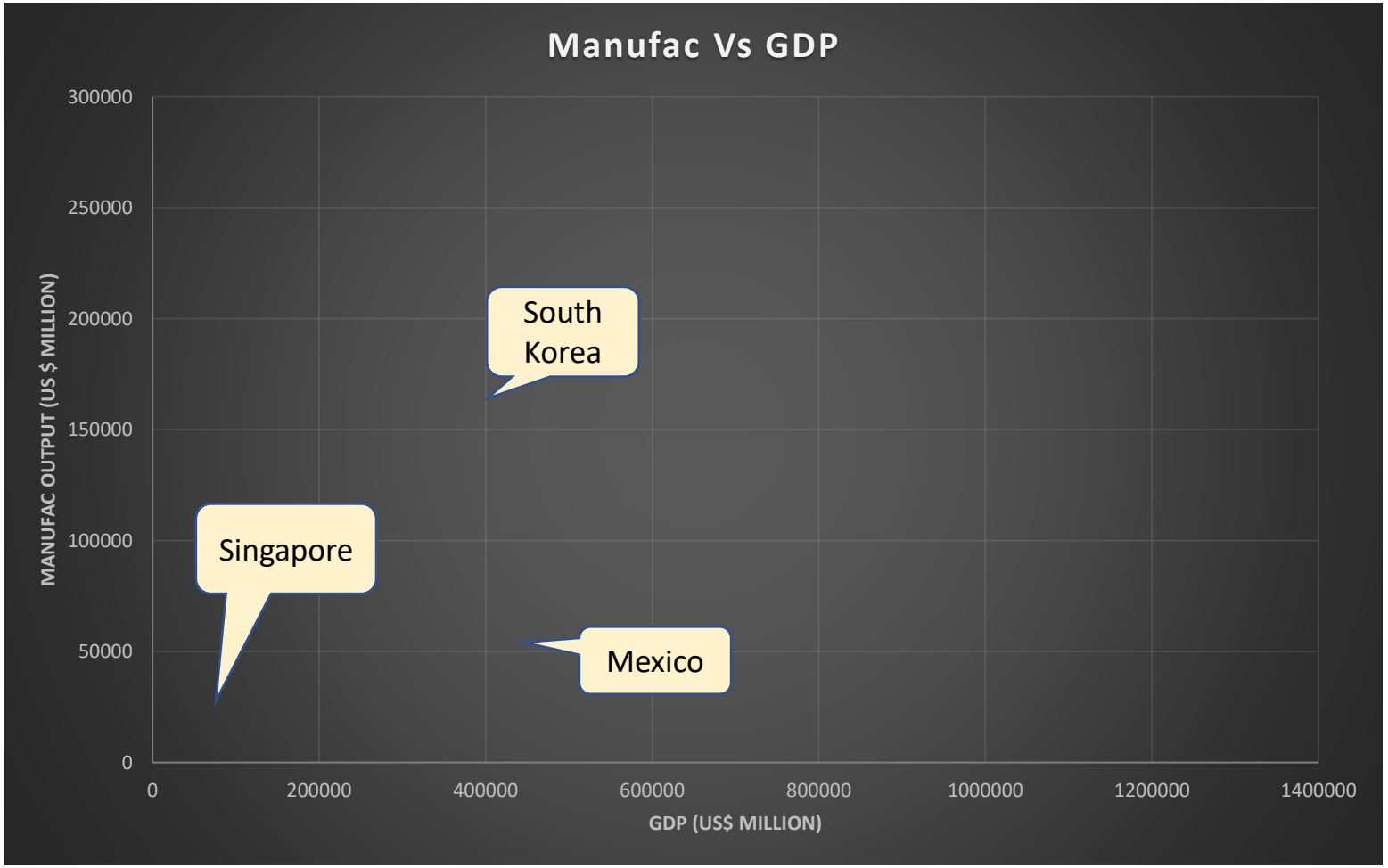
	A	B	C	D	E	F
1	Country	MANU	GDP	POP	MANU/POP	GDP/POP
2	Belgium	44517	232006	10.093	4411	22987
3	Canada	112617	547203	29.109	3869	18798
4	Chile	13096	50919	13.994	936	3639
5	Denmark	25927	151266	5.207	4979	29051
6	Finland	21581	97624	5.085	4244	19198
7	France	256316	1330998	57.856	4430	23005
8	Greece	9392	98861	10.413	902	9494
9	Hong Kong	11758	130823	6.044	1945	21645
10	Hungary	7227	41506	10.162	711	4084
11	Ireland	17572	52662	3.536	4969	14893
12	Israel	11349	74121	5.362	2117	13823
13	Italy	145013	1016286	57.177	2536	17774
14	Korea S	161318	380820	44.501	3625	8558
15	Kuwait	2797	24848	1.754	1595	14166
16	Malaysia	18874	72505	19.695	958	3681
17	Mexico	55073	420788	89.564	615	4698
18	Netherlands	48595	334286	15.382	3159	21732
19	Norway	13484	122926	4.314	3126	28495
20	Portugal	17025	87352	9.824	1733	8892
21	Singapore	20648	71039	3.268	6318	21738
22	Slovakia	2720	13746	5.325	511	2581
23	Slovenia	4520	14386	1.925	2348	7473
24	Spain	80104	483652	39.577	2024	12221
25	Sweden	34806	198432	8.751	3977	22675
26	Switzerland	57503	261388	7.104	8094	36794
27	Syria	3317	44753	13.84	240	3234
28	Turkey	31115	135961	59.903	519	2270
29	UK	244397	1024609	58.005	4213	17664

MANU = Manufacturing Output

GDP= Gross Domestic Product

POP = Population

Scatter Plot



DV = MANU, IV = GDP

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.943489
R Square	0.890172
Adjusted R	0.885948
Standard E	23461.99
Observatic	28

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	1	1.16002E+11	1.16E+11	210.7339	5.53E-14
Residual	26	14312086755	5.5E+08		
Total	27	1.30314E+11			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*pper 95.0%*
Intercept	603.8754	5699.68805	0.105949	0.916436	-11112	12319.75	-11112	12319.75
GDP	0.193693	0.013342803	14.51668	5.53E-14	0.166267	0.22112	0.166267	0.22112

Very good R Square!

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Can we trust these results? What about heteroscedasticity?

Testing of Heteroscadasticity: GOLDFELD-QUANDT TEST

	Country	GDP	MANU
1	Slovakia	13746	2720
2	Slovenia	14386	4520
3	Kuwait	24848	2797
4	Hungary	41506	7227
5	Syria	44753	3317
6	Chile	50919	13096
7	Ireland	52662	17572
8	Singapore	71039	20648
9	Malaysia	72505	18874
10	Israel	74121	11349
11	Portugal	87352	17025
12	Finland	97624	21581
13	Greece	98861	9392
14	Norway	122926	13484
15	Hong Kong	130823	11758
16	Turkey	135961	31115
17	Denmark	151266	25927
18	Sweden	198432	34806
19	Belgium	232006	44517
20	Switzerland	261388	57503
21	Netherlands	334286	48595
22	Korea S	380820	161318
23	Mexico	420788	55073
24	Spain	483652	80104
25	Canada	547203	112617
26	Italy	1016286	145013
27	UK	1024609	244397
28	France	1330998	256316

Lets order data from low to high & identify top 11 bottom 11 observations

Top 11; DV = MANU, IV = GDP

	Country	GDP	MANU
1	Slovakia	13746	2720
2	Slovenia	14386	4520
3	Kuwait	24848	2797
4	Hungary	41506	7227
5	Syria	44753	3317
6	Chile	50919	13096
7	Ireland	52662	17572
8	Singapore	71039	20648
9	Malaysia	72505	18874
10	Israel	74121	11349
11	Portugal	87352	17025

RESIDUAL OUTPUT

Observation	*Predicted MANU*	*Residuals*	***Residual^2***
1	2508.342423	211.657577	***44798.9299***
2	2656.071847	1863.928153	***3474228.16***
3	5070.986282	-2273.98628	***5171013.61***
4	8916.106208	-1689.10621	***2853079.78***
5	9665.60221	-6348.60221	***40304750***
6	11088.88288	2007.117117	***4028519.12***
7	11491.21474	6080.785263	***36975949.4***
8	15733.12666	4914.873336	***24155979.9***
9	16071.51938	2802.480624	***7853897.65***
10	16444.53617	-5095.53617	***25964488.9***
11	19498.6112	-2473.6112	***6118752.35***
			156945458
			RSS1

Bottom 11; DV = MANU, IV = GDP

11	18	Sweden	198432	34806	-9627.91
10	19	Belgium	232006	44517	-6150.15
9	20	Switzerland	261388	57503	1380.884
8	21	Netherlands	334286	48595	-21061.1
7	22	Korea S	380820	161318	83022.52
6	23	Mexico	420788	55073	-30642.8
5	24	Spain	483652	80104	-17282.9
4	25	Canada	547203	112617	3431.383
3	26	Italy	1016286	145013	-51261.1
2	27	UK	1024609	244397	46577.71
1	28	France	1330998	256316	1613.506

RESIDUAL OUTPUT

Observation	*Predicted MANU*	*Residuals*	***Residual^2***
1	44433.90628	-9627.90628	***92696579.3***
2	50667.14794	-6150.14794	***37824319.7***
3	56122.11626	1380.883736	***1906839.89***
4	69656.12623	-21061.1262	***443571038***
5	78295.48012	83022.51988	***6892738808***
6	85715.81141	-30642.8114	***938981891***
7	97386.94096	-17282.941	***298700048***
8	109185.6167	3431.383252	***11774391***
9	196274.0691	-51261.0691	***2627697201***
10	197819.2907	46577.70933	***2169483006***
11	254702.4943	1613.505684	***2603400.59***
			1.3518E+10
			RSS2

Conclusion, Ho: Variances are same

86.13169 =RSS2/RSS1= Test Stat

df = n'-k = 11-2 = 9

F(9,9) @ 0.1 LOS = 10.1

10.10663 Crit Stat

=FINV(0.001,9,9) = 10.10663

RESIDUAL OUTPUT

Observation	*Predicted MANU*	*Residuals*	***Residual^2***
1	2508.342423	211.657577	***44798.9299***
2	2656.071847	1863.928153	***3474228.16***
3	5070.986282	-2273.98628	***5171013.61***
4	8916.106208	-1689.10621	***2853079.78***
5	9665.60221	-6348.60221	***40304750***
6	11088.88288	2007.117117	***4028519.12***
7	11491.21474	6080.785263	***36975949.4***
8	15733.12666	4914.873336	***24155979.9***
9	16071.51938	2802.480624	***7853897.65***
10	16444.53617	-5095.53617	***25964488.9***
11	19498.6112	-2473.6112	***6118752.35***
			156945458
			RSS1

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RESIDUAL OUTPUT

Observation	*Predicted MANU*	*Residuals*	***Residual^2***
1	44433.90628	-9627.90628	***92696579.3***
2	50667.14794	-6150.14794	***37824319.7***
3	56122.11626	1380.883736	***1906839.89***
4	69656.12623	-21061.1262	***443571038***
5	78295.48012	83022.51988	***6892738808***
6	85715.81141	-30642.8114	***938981891***
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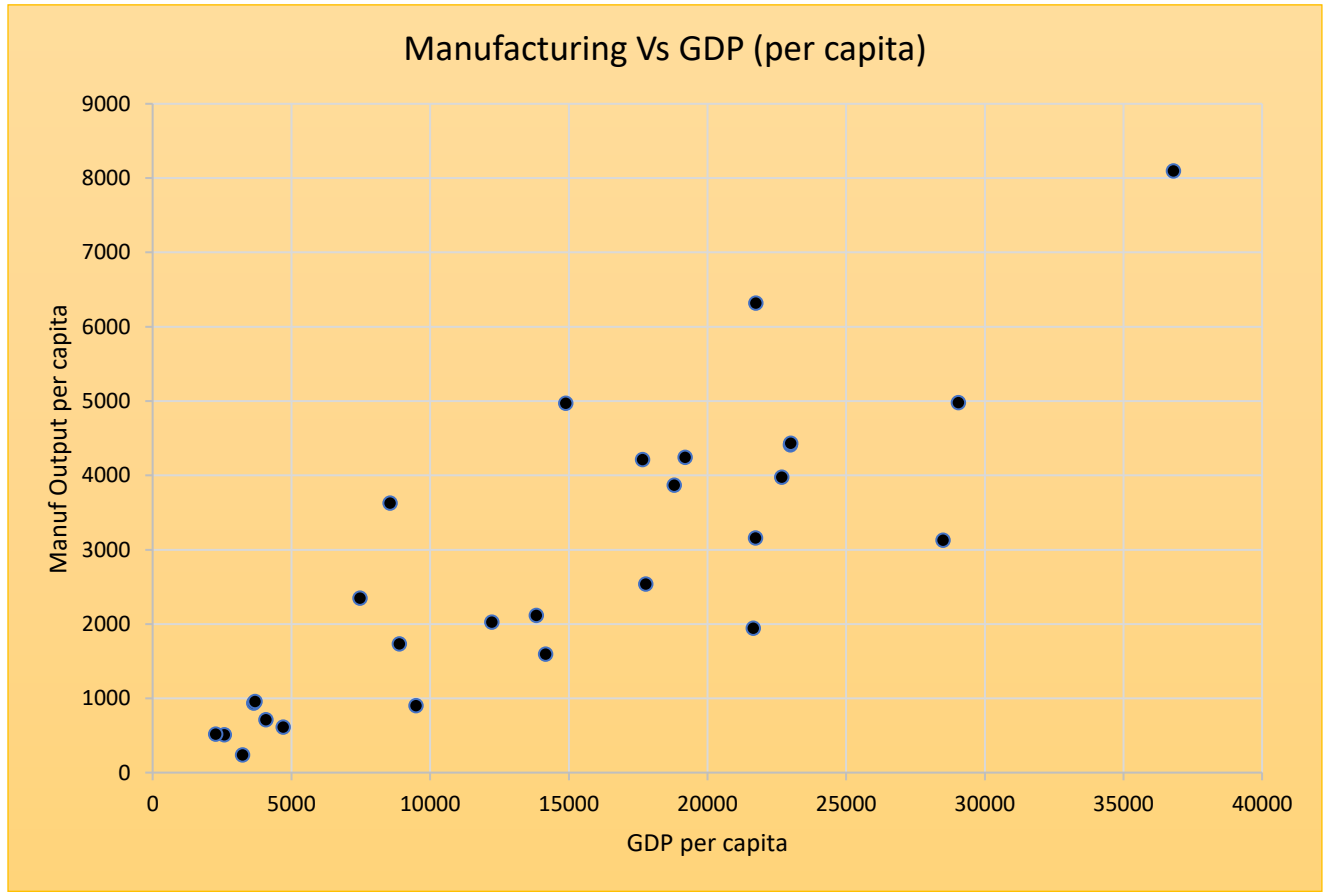
8	109185.6167	3431.383252	***11774391***
9	196274.0691	-51261.0691	***2627697201***
10	197819.2907	46577.70933	***2169483006***
11	254702.4943	1613.505684	***2603400.59***
			1.3518E+10
			RSS2

As Test stat (86.13) is > Critical Value (10.11), REJECT Ho

Let’s build GLS Model



We will divide MANU by POP and GDP by POP

Weighted Model

MANU/POP	1/POP	GDP/POP
511	0.187793	2581
2348	0.519481	7473
1595	0.570125	14166
711	0.098406	4084
240	0.072254	3234
936	0.071459	3639
4969	0.282805	14893
6318	0.305998	21738
958	0.050774	3681
2117	0.186498	13823
1733	0.101792	8892
4244	0.196657	19198
902	0.096034	9494
3126	0.231803	28495
1945	0.165453	21645
519	0.016694	2270
4979	0.192049	29051
3977	0.114273	22675
4411	0.099079	22987

SUMMARY OUTPUT

Scaled 1 model

No Intercept

per capita MANU & GDP & RECIPROCAL OF POP

Regression Statistics	
Multiple R	0.951479
R Square	**0.905312**
Adjusted R	0.863208
Standard E	1091.886
Observatic	28

ANOVA

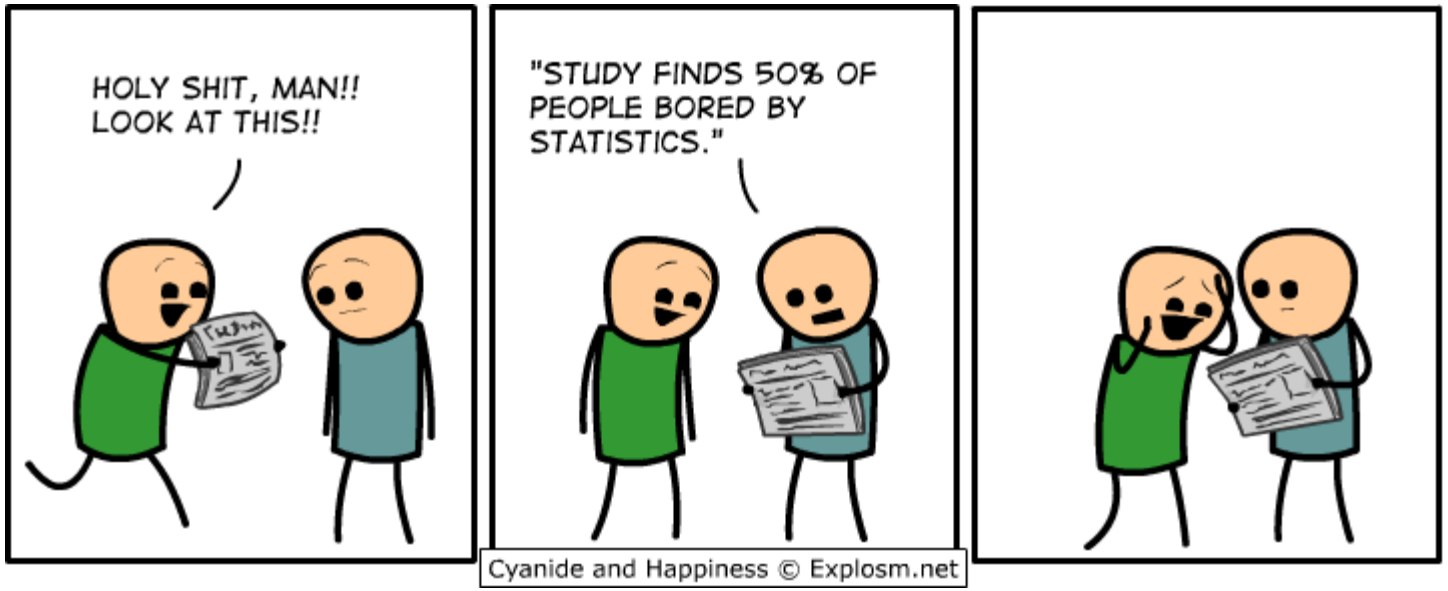
	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	2	296366291.7	1.48E+08	124.2924	1.02E-13
Residual	26	30997564.32	1192214		
Total	28	327363856			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A
1/POP	612.6525	1370.385339	0.447066	0.65853	-2204.21	3429.52
GDP/POP	0.182245	0.0155095	11.75057	6.67E-12	0.150365	0.214126

Heterosce dasticity?

Follow the same procedure
Conclusion, Ho: Variances are same

GOLDFELD-QUANDT TEST	
F ratio=	1.06178563
F crit	
@5%	3.1788931
@1%	10.1066279
@10%	2.44034044
As F stat < F Crit, ACCEPT	
NO PRESENCE OF HETEROSKEDASTICITY	


HOLY SHIT, MAN!!
LOOK AT THIS!!
"STUDY FINDS 50% OF
PEOPLE BORED BY
STATISTICS."
Cyanide and Happiness © Explosm.net


Statistics
organization
descriptive
scientific
analysis
collection
data
interpretation
statistical
Inference
theory
mathematical
experiments
science
probability
discipline
called
mathematics
provides
also
parameters
design
word
total